Forest Composition and Bamboo Distribution: Influences on the Distribution of *Hapalemur* species.
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Habitat degradation and altitude affect forest structure, forest composition, and therefore food sources available to primate species and their distribution. Two sites within Ranomafana National Park, in southeastern Madagascar are characterized by differences in altitude, habitat degradation, introduced tree species, and primate species distribution. One site, Tala, is 900 m in altitude, has some degree of habitat degradation, and has three species of *Hapalemur*: *H. griseus*, *H. aureus*, and *H. simus*. The second site, Vato, is 1150 m in altitude, is less disturbed, and has only *H. griseus*. To document further differences between the two sites, four 25 m x 5 m botanical plots were constructed at each site from May-Aug. 1996. At each site, two plots were placed inside culm bamboo patches and two were placed outside culm bamboo patches.

Based on botanical plots, Tala appears to be more botanically diverse based on the number of trees (n=239), the number of plant families (n=33), and the number of plant families that represent 50% of the trees in the plots (n=6). In contrast, Vato has fewer trees (n=157), fewer families (n=26), and fewer families which constitute 50% of the plots (n=4). The bamboo species also differ between the sites although the botanical plots at Vato have twice the number of bamboo culms, three times the liana stems, and one and a half times the stems of bamboo grass as Tala. In addition, the large bamboo, *Cephalostachyum cf. viguieri*, exists at Tala whereas a smaller-culmed species, *C. perrieri*, is present only at Vato. The fact that *C. cf. viguieri* is a major component of the diet of *H. simus* and *H. aureus* and *C. perrieri* is a major component of the diet of *H. griseus* may account for the lack of the two larger species of bamboo lemur at Vato. At both sites, liana bamboo is much more prevalent in the absence of culm bamboo and is more common at Vato in general. Since liana bamboo is also a major component of the *H. griseus* diet, its frequency and distribution may affect the feeding behavior and ranging patterns of *H. griseus* and therefore their distribution and population densities at these two sites.

Morbidity, pregnancy outcomes and fitness costs of sedentarization among pastoralist women in Uganda. SJ GRAY, University of Kansas, Lawrence, KS 66045. IL PIKE, Ohio State University, Columbus, OH 43210.

In this study, morbidity during pregnancy and pregnancy outcomes of sedentary Karimojong women in Moroto District, Uganda, are examined. The data used in analysis were obtained from outpatient summaries for 23 antenatal clinics, dispensaries and maternity units in Moroto for the period from January, 1992, through April, 1996. The Karimojong were traditionally an agropastoral population having strong affinities with neighboring Turkana pastoralists, of Kenya. Due to devastating livestock losses and agricultural development in the 1980s, many Karimojong now are sedentary farmers. Health services in Moroto District are located within the agricultural zone and are utilized extensively by the settled population. Nomads utilize health services infrequently or not at all.

The conditions most commonly diagnosed at Moroto antenatal clinics in this period were malaria and its complications, particularly, anemia. Both malaria and anemia are strongly and positively associated with the number of aborted pregnancies, preterm births and late-term pregnancy failures in Moroto; a weaker association exists between malaria and anemia and maternal mortality. Malaria also has a positive effect on the number of small-for-date (SFD) births.

Results are compared with findings from a study carried out in 1993-94 among nomadic Turkana women. Malaria and anemia also were implicated in pregnancy failures in Turkana, but the number of fetal losses and preterm births was higher in Turkana; the number of SFD infants and maternal deaths was higher in Moroto. Maternal malarial infection during pregnancy clearly places mothers and fetuses at risk in both groups, but in Turkana, in the absence of antenatal or obstetric care, "at risk" pregnancies may be terminated earlier, preferentially optimizing maternal survival over that of the fetus. In Moroto, difficult pregnancies may be more likely to be carried to term in the health care context, increasing survival risks to the mother. High maternal mortality and an increased number of full-term livebirths with lower likelihood of survival (SFD) may represent a fitness cost of sedentarization to Karimojong women.

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A reassessment of the relationship between dental wear and subsistence in the Levant. M.M. GLANTZ, University of Pennsylvania, Philadelphia, PA 19104

The pattern and extent of dental wear are commonly employed to discern subsistence strategies from skeletal material. Similarities in dental wear between Neandertals and modern gatherers and hunters are consequently interpreted as reflecting similarities in dietary composition and subsistence. However, a wide range of factors influence inter- and intra-population dental wear variability. These variables must be investigated in order to test competing hypotheses concerned with the proximal cause of attrition patterns.

A large sample of first mandibular molars (n=300) was examined from temporally diverse Levantine populations. This sample included recent Bedouin material as well as archaeological material from Neolithic, Byzantine, Arab period, Natufian, and Mousterian sites. The geographically circumscribed nature of these samples and supporting archaeological data allowed for an analysis of dental wear in populations whose environments and general subsistence strategies were known. Attrition was scored in a variety of ways: angle of attrition, crown height, dentin exposure, size, extent and orientation of attrition facets and the form of the worn sufaces were recorded. A number of mandibular and condylar measurements were also part of the analysis. A

multivariate analysis of variance (MANOVA) was employed in order to determine the proximal cause of dental wear and to assess inter- and intra-population wear variability in this broad Levantine sample.

The results of this research indicate that dental wear patterns are a relatively poor indicator of subsistence when other variables are considered. Similarities between human populations in bite force, mandibular morphology, masticatory muscle mass, tooth architecture, and the microstructure of the dental tissues may more effectively reflect the trajectory of dental wear than subsistence alone. Moreover, differences between populations such as Neolithic agriculturists and Mousterian gatherers and hunters may indicate general biological and morphological divisions rather than ones based on dietary composition and subsistence.

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Measuring "rates" of follicular atresia: a cautionary tale. L.R. GODFREY[1], L.E. LEIDY[1], and M.R. SUTHERLAND[2], Dept. of Anthropology[1] and Statistical Consulting Center[2], University of Massachusetts at Amherst, MA 01003-4805.

Age at menopause is determined by the number of oocytes created through mitotic division by the fifth month of gestation, rate of oocyte loss across the lifespan through the process of follicular atresia, and the threshold number of ovarian follicles required to support menstruation. Scatterplots of log follicle number by age have been used to describe the rate of follicle decline and a consensus has emerged that oocyte depletion accelerates towards the onset of menopause, as revealed by a bend in the scatter of points on a semilogarithmic plot of follicle number by age. This bend has been interpreted as signifying a change in the "rate" of follicular loss at around age 38 Thus, follicular atresia has been interpreted as "biphasic".

This paper uses data drawn from published follicle numbers collected from autopsy studies of infants and adults as well as from histological analysis of ovaries obtained from women undergoing surgery for gynecological disorders not involving ovarian pathology. Four mathematical models were tested to determine whether or not follicular depletion data support the inference of a biphasic follicular atresia or the acceleration of follicular loss 10 years prior to menopause. We conclude that they do not.

Relationships that are linear on original measurement scales may bend when plotted on semilogarithmic scales. This has been one source of confusion in describing the "rate" of follicle loss. We show that on original measurement scales there is no perturbation in the data at ages 38 to 40. There is also no evidence that the probability of follicle degeneration increases abruptly at such a threshold age. Furthermore, the instantaneous rate of follicle loss is lower after age 40 than ever before.

Comparative behavioral ecology of sympatric Bwindi gorillas and chimpanzees, Uganda: preliminary results. M.L. GOLDSMITH and A.E. HANKE, Dept. of Anthropology, Dartmouth College, Hanover, NH 03755, J.B. NKURUNUNGI, Dept. of Zoology, Makerere University, Kampala, Uganda, and C.B. STANFORD, Dept. of Anthropology, University of Southern California, Los Angeles, CA 90089.

In January 1997, a research project was started on the comparative behavioral ecology of gorillas (*Gorilla gorilla beringei*) and chimpanzees (*Pan troglodytes scheinwurthii*) in Bwindi-Impenetrable National Park in southwestern Uganda, the only forest in which these apes are sympatric. During a two month pilot study, daily follows were conducted on two habituated gorilla groups. The Buhoma group (n = 14) was at a low elevation (1,450 m) and the Ruhija group (n = 13) was at a high elevation (2,100 m). Information on chimpanzees was also collected. Objectives of the pilot study were to collect data on vegetation, diet, daily ranging and grouping behavior, and to select sites for the long-term field study.

Preliminary observations suggest that chimpanzees occur at higher density in lower elevations since fresh evidence was found on 75% of the days while at Buhoma. Analyses of chimpanzee fecal samples demonstrated, however, that many of their foods (mainly figs) were not important food items for gorillas during the study period. In contrast, in Ruhija, no fresh evidence of chimpanzees was found during the study. Preliminary analyses of the vegetation show that stem density and diversity are higher at Buhoma, although these gorillas had a less diverse diet than those at Ruhija. In addition, the Buhoma group traveled shorter daily distances and slept in more cohesive groups than the Ruhija group.

During our study, the gorillas at Buhoma spent a large percentage of their time in and around the tourist camps where herbaceous vegetation was abundant due to artificial forest clearings. It is unclear what effect this situation had on their ranging and grouping behaviors. Present and future study of the gorillas in the low elevation section are concentrating in the Nteko region, where tourism is not present. During a three day visit to this area in January 1997, gorilla fecal samples from a 16 member group contained large amounts of fruit and chimpanzees were heard pant-hooting nearby on all three days. In addition, in August 1997, a chimpanzee party was followed over 7 days on which nesting and diet data were collected.

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Bigger is better: primate brain size in relationship to cognition. K.R. GIBSON, Basic Sciences, University of Texas Houston, Houston, TX 77225, D.RUMBAUGH, Biology and Psychology, Georgia State University, Atlanta, GA 30303 and R. BYRNE, Psychology, University of St. Andrews, St. Andrews, Fife, KY16 9JU, Scotland

Many investigators have assumed that brain size relative to body size and/or ratios of neocortical size to size of other neural structures are better measures of

intelligence than is absolute brain size. Jerison followed this trend, when in his influential 1973 volume, he defined the encephalization quotient (EQ) as the ratio of actual brain size to expected brain size for a mammal of similar body size and provided EQs for numerous extant and extinct mammals.

Statistical analyses presented in this paper indicate that body size, absolute brain size and absolute sizes of several neural structures, including the neocortex, cerebellum, basal ganglia, and hippocampus, reflect the cognitive differences between great apes and monkeys that have been found in many recent studies. EQs and neocortical ratios do not reflect these differences. Absolute brain size and body size, but not EQ, also correlate with performance on laboratory tests of capacities for learning complex tasks and for transferring learning from one task to another.

These findings suggest that absolute brain size better assesses potential intelligence than does EQ and that absolute brain size may be a better indicator of the intellectual skills of extinct hominids.

BIRTH weight, length and body composition among Black-Americans, and White-Americans of low socioeconomic status.

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Birth weight is often used as an indicator of neonatal health status and of the quality of the fetal environment. Comparisons of birth weight among ethnic groups have been confounded by covarying socio-economic variation. This research compares anthropometric measurements of White and African-American newborns of low socioeconomic status.

The sample was drawn from women served by the obstetric clinics at either Albany Medical Center or Albany County Department of Health between September, 1992 and August, 1996. Data were obtained from maternal interview, hospital records and anthropometry. Measurements made on the newborn were weight, crown-heel length, head, chest and arm circumferences, subscapular and triceps skinfold thickness. Race/ethnicity was determined through maternal self-identification.

Mean birth weight for White Americans (n = 153) was 3,408 grams, approximately 170 grams greater than African Americans (n = 216; 3,237 grams). t-tests revealed a statistically significant difference between African Americans and White Americans in birth weight ($p<0.009$), length ($p<0.037$), head circumference ($p<0.029$), and chest circumference ($p<0.045$) with African-Americans smaller in each measurement. After stratifying by sex, white males were significantly larger than black male neonates, while black and white female neonates did not differ significantly in birth size.

Multivariate analysis, after controlling for relevant biologic, socioeconomic and demographic variables, showed similar results.

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Markers of Childbirth? Effect of Body Size and Pubic Morphological Change.

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Attempts to determine parity have met with contradictory results. In this study, we focused on factors which affect the manifestation of "parity markers", whatever the actual cause, hypothesizing that differences in body size may affect anatomical changes during pregnancy and childbirth.

A random sample of pubic bones from the collections of L.A. County Coroner's Office included 54 males (17 to 76 yrs) and 148 females (17 to 99 yrs). Age, stature and weight at death were obtained. Information on number and timing of births was available for females. Average reported births are higher among older women. Measurements taken directly from pubic bones include: symphyseal surface height and width, pubic tubercle height, pubic bone length. Symphyseal area, subpubic angle, retropubic angle, and arcuate angle were obtained from photographs. Dorsal pits were assessed according to the Ullrich classification system (1975).

Males are significantly larger in all dimensions except pubic body length. Males and females show significant positive correlation between age and area, height, and width of the symphyseal surface. Age is negatively correlated with stature and retropubic angle. In females, stature correlates with symphyseal area and right symphyseal height, as well as the reported weight and is negatively correlated with age. Weight is correlated to symphyseal area and height. Male stature is correlated with symphyseal height, width and area and pubic length while weight is positively correlated with symphyseal area and width, pubic length and subpubic angle.

Dorsal pits increase with reported births, but dorsal pits tend to be associated with longer pubic bones and negatively associated with stature. Pubic tubercle height only correlates with arcuate angle. While pits may be linked to childbirth, increased frequency also may be due to 1) shorter women with longer pubic bones being more likely to develop pits, 2) age-related pubic changes, or 3) secular differences in childbirth and stature. The ultimate question is how are pits formed. Often considered avulsive, pit morphology suggests they are more resorptive, possibly in response to scar tissue formed after ligamentous tearing which becomes incorporated into the joint.

Asymmetries in cerebrocortical language area homologs of non-human primates. P. J. GANNON, Department of Otolaryngology & School of Biomedical Sciences, Mount Sinai School of Medicine, New York, NY, 10029-6574.

Epicenters of language areas in the cerebral cortex of the human brain are characterized by gross morphologic asymmetry with left hemisphere predominance. Previous studies have demonstrated homologous regions in the brains of non-human primates via use of cytoarchitectonic and connectional criteria. This study was designed to determine whether a similar pattern of gross anatomic asymmetry was present by comparison of these homologous regions in the brains of two representative catarrhine primates, macaques and chimpanzees.

Brains of *Macaca fascicularis* (n=17) and *Pan troglodytes* (n=18) were used. In the macaque brains both surface (s) and depth (d) measures of the arcuate sulcus (AS), central sulcus (CS), and sylvian fissure (SF), adjacent to human language area homologs, were made. In brains of chimpanzees, the surface area of the planum temporale (PT), a key site within the superior temporal gyrus, was measured. In both cases measures were made on the left (LH) and right hemispheres (RH). Statistical analysis involved use of analysis of variance and the paired sample Student's t-test (significance at $P<0.05$).

Results of macaque measures showed a RH predominance of s-AS and a LH predominance of d-AS. No hemispheric asymmetries of s-CS, d-CS s-SF or d-SF were apparent although females (n=8), but not males, did show LH predominance of d-CS. In chimpanzees, PT surface area was larger on the LH in 17 brains.

In macaques, the marked LH vs RH predominance of d-AS and s-AS respectively indicates that regional homologous and homotypic cortical mass may have a mosaic distribution. Similarly, communication circuitry in human brains is represented by a bilateral functional mosaic. In chimpanzees, the human-like pattern of planum temporale LH-predominance supports the hypothesis that, like humans, they may use this key brain language region for their own form of language. However, unlike humans who primarily use the vocal-auditory channel, chimpanzees likely use the gestural-visual modality.

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Proconsul – Thick or Thin? A study of enamel thickness and its significance. D. G. Gantt, Department of Biology and J. A. Rafter, Department of Math and Computer Sciences, Georgia Southern University, Statesboro, GA 30460.

Martin (Andrews & Martin, 1991) described *Proconsul* as having "thin" enamel and suggested that thin is the ancestral condition for the hominoid clade. This proposal was based upon the use of Martin's *relative enamel thickness index*. However, Gantt (1986) had described *Proconsul* as having "thick" enamel and that thick enamel was the ancestral condition for the hominoid clade. Therefore, the purpose of this study was to determine if *Proconsul* had "thin" or "thick" enamel.

Enamel thickness data was obtained from molars of *Proconsul africanus, P. heseloni, P. major,* and *P. nyanzae* and compared to thickness data from extant hominoids, *Australopithecus* and *Sivapithecus*. Sectioned teeth, fractured specimens, thin sections, and published photographs were used to obtain both linear and area measurements.

Analysis was based upon thickness measurements of cuspal, occlusal, and lateral enamel thickness as described by Gantt (1977), Martin (1983) and Macho (1994). Six enamel thickness measures were selected for analysis, which represented thickness over the cusps, occlusal surfaces and the sides of the tooth. Area measurements were used to calculate the *relative enamel thickness index*.

Results of the linear enamel thickness measurements reveal that enamel thickness in *Proconsul* is similar to that found in *Sivapithecus* and *Pongo*, described as "thick" enamel. Furthermore, measurements of relative enamel thickness also fell into the thick category. These data support the proposal that *Proconsul* has "thick" enamel and that "thick" enamel is the inferred ancestral condition for the hominoid clade.

The genetic ancestry of modern humans: inferences from the analysis of DNA sequence diversity at the human β-globin locus. S. M. FULLERTON[1], M. T. WEBSTER[2], Y.-T. LIU[2], R. M. HARDING[2], R. C. GRIFFITHS[3] and J. B. CLEGG[2], [1]Department of Anthropology, University of Durham and [2]Institute of Molecular Medicine, University of Oxford, U.K., and [3]Department of Mathematics, Monash University, Australia.

Sequence analysis of allelic variation in single copy nuclear DNA identifies polymorphism suitable for population genetic analysis of gene genealogy. We investigated allelic sequence diversity in a 3 kilobase-long region encompassing the human β-globin gene and determined a fully-resolved unique gene tree for 400 haplotypes sampled from 10 populations. Time to the most recent common ancestor and the ages of individual mutations on the tree were estimated in a maximum likelihood analysis assuming a coalescent model. A revised analysis assuming a model based on the coalescent, but allowing structured migration between subpopulations, permitted inferences regarding the distribution of diversity between African and Asian populations.

The most recent common ancestor of the β-globin gene tree is a sequence haplotype found only in Africa and estimated to have arisen approximately 800,000 years ago. A number of mutations older than 200,000 years define three

major lineages of the tree, designated A, B and C. The widespread distribution of lineage C in Asia but not in Africa indicates population structure at the continental level and we have found that models incorporating migration between African and Asian subpopulations provide a significantly better fit than those assuming random mating. However, reduction of rates of migration back into Africa to zero, in accordance with an 'out-of-Africa' model, reduces the likelihood of the model and this difference is significant. These findings are not easily reconciled with a recent unidirectional migration out of Africa.

The use of computerized tomography in identifying human remains in unexcavated burials. B. FROHLICH, B. FALKOWSKI and N. LYNNERUP. Dept. of Anthropology, Smithsonian Institution, Washington, D.C. U.S.A.; Siemens Medical Systems, Inc., Training and Development Center, Cary, North Carolina, U.S.A. and Laboratory of Biological Anthropology, Dept. of Forensic Medicine, University of Copenhagen, Denmark

Computerized Axial Tomography (CT scanning) techniques are extensively employed in our organizations to describe and analyze skeletal tissue, soft tissue, mummified tissue, fossils, and cultural objects. CT scanning has allowed us to examine objects in a non-destructive way, otherwise not possible by traditional methods.

More recently, CT scanning has proven to be highly successful in determining the size and shape of human skeletal remains within unexcavated matrixes of soil. Four infant burials from a Colonial burial ground in St. Johnsbury, Vermont (1790 to 1855) were removed intact and unexcavated in casts consisting of plaster of Paris and plywood. The casts were scanned using Siemens Somatom Plus and AR.T equipment at the Siemens Medical Systems in North Carolina and at the Smithsonian Institution. Two millimeters transverse slices were recorded of the entire length of each cast. Siemens Recon Plus software and MPR (Multiple Planar Reconstruction) were used to electronically reconstruct arbitrary oblique slice planes from a selected stack of contiguous transverse tomograms. The approximate coronal slices resulted in a display of the entire skeleton. Maximum lengths of long bones in the upper and lower extremities were recorded by electronically defining the proximal and distal ends. Later exposure of the long bones and subsequent measurements revealed no discrepancies between the measuring methods.

Our results have demonstrated that the application of CT scanning is highly applicable in archaeological, anthropological and forensic cases especially in instances where there may be a request for non-destructive recording. A Siemens AR.T scanner, now located at the Natural History Museum at the Smithsonian Institution, has allowed us unrestricted and limitless access to CT technology in a non-medical environment.

Sexual dimorphism in the postcranium of callitrichid primates. S.M. FORD and L.C. DAVIS, Dept. of Anthropology, Southern Illinois University, Carbondale, IL 62901-4502.

Most anthropoids range from mildly to markedly positively sexual dimorphic in body weight. The diminutive callitrichids however, are primarily monomorphic, with dimorphism ranging from slightly male-skewed to slightly female-skewed (negative). Previous studies have explored possible relationships between size dimorphism and the relatively unique form of callitrichid social organization. However, the relationship between body weight sexual dimorphism and dimorphism in skeletal dimensions has not been fully addressed.

This study of 120 skeletons of eleven callitrichid species explores the following issues: 1) do significant differences exist between the sexes in linear, angular, or areal dimensions of the callitrichid appendicular skeleton; 2) does the presence, degree, or direction of skeletal dimorphism correlate with weight dimorphism; and 3) are skeletal dimorphisms widespread or focused in single anatomical regions? Student's t-tests were used to determine whether the sexes differed significantly. ANOVA was used to compare skeletal and body weight dimorphism indices.

Each species exhibited some skeletal sexual dimorphism, although the pattern and degree of dimorphism was idiosyncratic to individual species. *Callithrix jacchus* and *Saguinus fuscicollis* are skeletally dimorphic in the least number of traits, while *Cebuella pygmaea* and *S. mystax* are dimorphic in the greatest number of traits.

The relationship between direction and degree of weight dimorphism and of skeletal dimorphism was not always consistent across species. For example, *S. mystax* and *C. pygmaea* are negatively dimorphic (females larger) skeletally but nearly monomorphic in body weight. *C. jacchus* is among the most dimorphic in weight, but the least dimorphic in postcranial dimensions. Alternately, *S. nigricollis* is mildly negatively dimorphic in both body weight and skeletal dimensions.

No clear pattern emerged as to location of dimorphic traits in the callitrichid postcranium. Of all traits, those in the pelvis were most frequently dimorphic, although not all species exhibited pelvic dimorphism. The foot was the next most common region to demonstrate sexual dimorphisms, while features in the scapula rarely showed dimorphism.

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Relative brain size in men and women: an evolutionary perspective. D. FALK and N. FROESE, Department of Anthropology, SUNY at Albany, NY 12222.

It is well known that adult men have on average larger brains than adult women. Across the globe, female brains average 91 percent (ranging between 88-94 percent for different populations) of the mean male brain size. The average brain size of many series of adult human males is 1,345 grams, and 91 percent of that mean is 1,224 grams

as an estimated average adult female brain size. What does the extra 121 grams in "average" male brains mean? Analysis of data from the literature reveals that, for any given body weight or stature, mean relative brain size (brain size divided by weight or stature) is indeed larger in males than in females. However, brains scale allometrically, i.e., they are relatively larger in smaller than in bigger people, and the average women is neither as heavy nor as tall as the average man. Our analysis reveals that the average brain size/body weight ratio is slightly but significantly greater in women than in men, despite the fact that females have more body fat. Thus, the relatively larger brains of average females is due to scaling factors associated with smaller bodies, whereas the extra 121 grams in average male brains may not be attributed to allometry because males, on average, have larger brains than females of the same body size. It is hypothesized that certain cognitive specializations evolved differentially (but not exclusively) in men and women, and that these parallel sex differences that occur in other animals. A classic example is visuospatial processing which is generally more developed in males than females of certain species, including humans. Because such abilities are not reflected in higher mean encephalization quotients for men than women, it is hypothesized that visuospatial tasks may require more neurological hardware, similar to the manner in which generating graphics on a computer requires more hardware than generating text.

Ritual destruction of human remains: A case in southeastern Ohio. H.J.H. EDGAR, Ohio State University, Columbus OH 43210.

The Richards Site is attributed to the Philo phase of the Fort Ancient tradition of the Ohio Valley. Site occupation dates to the latter half of the 13th century. While the architecture and design of the site generally fits the Fort Ancient pattern, the disposal of human remains is entirely unique for the area. The general pattern of Fort Ancient burial is discrete pits containing only human remains. In contrast, at the Richard's site bodies were disposed in general trash middens, mixed with faunal bone and other cultural trash. A central plaza is ringed by 635 midden features. A sample of 17 features yielding over 8,000 human bone fragments was taken representing all areas of the ring. Skulls and femora from this sample were examined for evidence of taphonomic changes due to cultural factors. Remains exhibit evidence of cutting, burning, green breakage, and polishing. The majority of burning is observable on the skulls. Some skulls were broken before burning, while others were burned prior to breakage. Cut marks on the femora are concentrated at areas of muscle attachment. Fragments of a single bone were found in separate features, indicating scattering of single individuals. Description of the remains is followed by a discussion of possible explanations for the taphonomic patterns, including secondary burial, ritual destruction, and cannibalism.

Play as a developmental process P DOLHINOW. Anthropology, University of California, Berkeley,Ca. 94720.

Playful activity is a complex indispensable activity of immaturity with boundaries that resist easy definition or understanding. The long term effects of immature play can impact adult behaviors ranging from agonistic to affiliative and reproductive. Play is a critical part of the environment of development and is most accurately viewed as a process rather than a series of events. It is not unitary in form or function; rather, its' very flexibility and invasiveness or omnipresence in many arenas of behavior provides a way of calibrating experiences and of integrating them into life patterns. It is vitally important in both physical and social development, but the process by which playful activity translates into short and long term effects, useful to the individual, and the effects themselves, are subject to debate. The developmental and evolutionary implications of playful activity are related for primates, and it is apparent that play mirrors patterns of action and interaction characteristic of the participant's species.

The first task is to identify and characterize playful activity. Assumptions of what is properly included in play often identify behaviors on the basis of apparent imperfection of execution or lack of resemblance to the adult behaviors we assume they represent. Playful activity grades into many other activities making it difficult and probably inadvisable to draw neat lines between categories. Although the clues to a solution of what the animal is doing may lie in the animal, and thus be effectively out of our reach, we have needlessly handicapped our investigations by ignoring the role of playful activity as an important process of development closely related to later behaviors that lack playful qualities. The function of a particular category of behavior such as play may change dramatically as the animal matures. So too do the processes by which play translates into short and long term gains for the individual. Our traditional definitions do not reflect these changes or the dynamic of the activities included in playful behavior.

A five generation study of the Indian langur (Presbytis entellus) provides a data base for the consideration of playful behavior as a developmental process.

The value of postcranial variation in studies of modern Homo sapiens; an Australian focus. D.A. DONLON, Department of Anatomy and Histology, University of Sydney, NSW, 2006, Australia.

Traditionally physical anthropologists have been concerned with describing variation in contemporary Homo sapiens in terms of cranial metric variation. According to the non-specificity hypothesis there are no distinct large classes of genes affecting one group of attributes exclusively, thus there is no theoretical reason why postcranial nonmetric traits should not do as well as other osteological data sets in addressing

questions of population relationships. This paper addresses the question of the value of postcranial nonmetric variation in the study of population relationships using samples from populations originating from five major geographical regions - Australia (two populations), Africa, East Asia, Europe and Polynesia.

Using the mean measure of divergence, postcranial nonmetric traits are shown to be useful in separating the samples in female and pool-sex samples. The two Australian samples (New South Wales coastal and South Australian Aboriginals) are shown to be closer than any other two samples. The significance of the findings in this study is that the picture of intrapopulation and interpopulation variation in postcranial nonmetric traits is extended and clarified, especially in relation to other types of osteological data. Distance studies using postcranial nonmetric traits are possible but more illuminating if the sexes are first separated. Postcranial nonmetric variation does have value in human population studies in that it yields biological meaningful results, especially in conjunction with other types of osteological variation.

Interpretation of population structure when group structure is unknown. S.M. DONNELLY, University of Utah, Salt Lake City, UT 84112, L.W. KONIGSBERG, University of Tennessee, Knoxville, TN 37996, and C.B. STRINGER, The Natural History Museum, London SW7 5BD, UK.

There are two main impediments to making population structure interpretations from paleoanthropological data. The first problem is that taxonomy must generally precede interpretation, and this often leads to the observer's objectivity being called into question. The second problem is that any interpretation of population structure must be framed within some type of modern referent. We attempt to address both of these problems using methods that are objective, though certainly open to question regarding the *stated* assumptions.

We analyze eight craniometric measurements (GOL, NOL, BNL, XCB, ASB, FRC, FRS, and FRF) on 16 Neandertals and 65 early modern humans using a missing data finite mixture analysis. In a two group mixture analysis 87.5% of the individuals that we would have classified as Neandertals are assigned to one group, and 95.4% of the moderns are assigned to the second group. The resulting Mahalanobis D^2 (corrected for small sample size) is 14.12, which under the assumptions that: 1) early modern humans' total population size was nine times that of Neandertals' and 2) the average heritability of the craniometrics was 0.55, would produce an F_{st} between Neandertals and early moderns of about 0.13.

When viewed against published values of F_{st} among continental divisions of extant humans, the value of 0.13 is within the range expected for the human species. However, the value we obtained from 81 fossils cannot be analogized to published values for extant humans, because the sampling process is so different for the fossil data. In a Monte Carlo study using W.W. Howells' craniometric data and a sampling scheme as similar as possible to that which generated the fossil data, we show that an F_{st} value as high as 0.13 could only be obtained within the human species if that species had a level of variation much greater than observed today.

Patterns of morbidity in Karamoja, Uganda, 1992-1996. H DEVLIN and S J GRAY, University of Kansas, Lawrence, KS 66045-2110.

The Karimojong of northern Uganda are closely related by a pastoralist tradition to the Turkana of Kenya. In response to drought, famine, livestock losses and intratribal raiding, many Karimojong have become increasingly sedentary and agricultural. Resulting ecological changes are expected to have affected their health. However, social unrest in Uganda precluded field study until recently, and health service records are currently our only means of health assessment in Karamoja. This study uses summaries of attendance at hospitals, health centers and dispensaries to investigate disease patterns and adaptability among settled Karimojong. These data suggest that disease and social conflict exert dual and synergistic selection pressures on this population.

Data include monthly health unit attendance and frequency of diagnoses for 4 age groups for the period from January, 1992, through April, 1996, and monthly rainfall for the same period. Time series analysis was used to identify seasonality. Analysis of variance was used to compare frequencies of attendance and diagnoses in different age groups and successive years.

During the period of the study, peak rainfall occurred in April and May, followed two months later by a sharp increase in health unit visits. Malaria and upper respiratory infections were the leading diagnoses during all months for attendees of all ages. Diarrhea was the third leading diagnosis for children under age 5, but for attendees 5 years or older, the third leading diagnosis was trauma. Trauma-related visits showed an increase at the same time as rainfall-driven diagnoses, such as malaria, upper respiratory infections, and diarrhea.

During the study period, trauma often was caused by firearms used in cattle raids. Karimojong men move the cattle in the rainy season, and raiding increases at that time. This pattern suggests that men and boys may be at greater risk of injury in the wet season, when women and young children experience increased infection. From these results, it is argued that sedentarization in response to social and environmental stress has intensified selection pressures in this population.

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Tetracycline labeling in an ancient Nubian X-group (24-I-3) population. J.A. COOK, Emory University, Atlanta, GA 30322.

The prevalence of tetracycline labeled osteons was investigated in 29 individuals from an ancient Sudanese Nubian X-group cemetery (24-I-3) dated from 350 CE - 550 CE. Femoral thin sections from below the lesser trochanter were hand ground and viewed under fluorescence microscopy at 490 nm. The presence of tetracycline is indicated by bright yellow-green fluorescence. Each thin section was analyzed using Frost's (1996) "Triple-Surface-System," which yielded 24 fields from each individual.

In the study, a distinction was made between intact osteons totally labeled with tetracycline and osteons with only hyperdensity innerlamellae (HDI) bodies labeled. The bones of all individuals of all ages show at least some evidence of in vivo tetracycline labeling. Of the over 18,000 haversian systems sampled, approximately 5.00% of the intact osteons were completely labeled, and 9.9% intact osteons with only the HDI labeled. The prevalence of labeling was significantly lower than reported from another X-Group site (NAX) from this same region (Collins and Armelagos 1997).

Tetracycline, used today as a common antibiotic, was incorporated in the diet of the ancient Nubians through a fermentation process that produced beer and cereal gruel. Differences between the populations may reflect differences in available grains for beer production.

Dental anthropology of prehistoric Sardinians (V-I millennium B.C.): oral pathologies, metric and non-metric traits. A. COPPA, A. CUCINA, R. VARGIU, Università di Roma "La Sapienza", Italy; G.C. COSSEDDU, G. FLORIS, R. FLORIS, Università di Cagliari, Italy; M. LUCCI, Università di Sassari,, Italy

As a consequence of an accurate chronological calibration of the dates by radiometric analyses, it has been possible to create a well determined anthropological database that allows to carry out a preliminary analysis of the prehistoric populations that settled the Sardinia island during prehistory. Located in the middle of the Mediterranean Sea, it is set long migratory and commercial routes that cross the Basin, but at the same time was characterized by a geographical and cultural isolation, as previously put in evidence by genetic analyses. The dental remains of prehistoric inhabitants from 26 necropoles, gathered into five chronological subsequent periods [Neolithic (NEO), Copper Age (CA), Early Bronze Age (EBA), Middle Bronze Age (MBA) and Late Bronze Age- Early Iron Age (LBEI)] have been analyzed in order to point out the biological relationships and the changes of subsistence patterns through time. Metric traits (M-D and B-L diameters), and morphologic traits (scored according to the ASU system) have been detected. Also, caries, according localization on the crown and intensity, ante mortem tooth loss, and periapical defects have been scored. Metric traits have been used in order to estimate the pattern of dental reduction, and, together with the non-metric traits, to evaluate the peopling pattern of the island. To find out the genetic relationships among the populations, non-metric traits have been analyzed by the principal component analysis and the maximum likelihood (its robustness was tested by the "bootstrap"). The morphometric analysis shows sort of a trend of dental reduction. The analysis of phenetic distances shows a good degree of likelihood between the EBA and the MBA, since they are grouped together 67% of the times. The NEO group results to be separated from the rest of the groups, while the CA and the LBEI are associated in 51 out of 100 cases. Caries and AMTL strongly increase from the NEO to the CA (caries 9.9% NEO Vs 18.3% CA; AMTL 9.7% NEO Vs 15.5% CA); a drastic decrease during the EBA (4.6% caries and 6.3% AMTL) and again during the last period an increase to frequencies as high as in the NEO (about 10.0% caries and 12.0% AMTL). Periapical defects are similar during the two latest periods (10.0% and 11.0%), decrease in the LBA (4.0%) and increase during the last two ages (10.0% and 11.0%). These results seem to support an increase in the agriculture as subsistence pattern from the NEO to the CA, while other patterns (stock-racing) seem to have characterized mainly the LBA and partly the latest periods.

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Comparison of Body Composition Among Settled and Nomadic Turkana. S CORBETT, S GRAY, University of Kansas, Lawrence KS 66044; B CAMPBELL Northwestern University, Evanston IL 60208; PW LESLIE University of North Carolina, Chapel Hill NC 27599.

Adoption of farming along the rivers of Turkana, Kenya has lead to the settling of traditionally nomadic Ngisonyoka Turkana pastoralists. The impact of resulting changes in activity, disease, and diet have not previously been investigated. This study quantifies the effects of subsistence transition on nomadic and settled Turkana body composition.

Samples consist of 93 nomadic and 81 settled males, and 184 nomadic and 107 settled females. Anthropometric measurements (height, weight, skinfolds, circumferences) were taken in 1989-1990, and 1994. The two groups were compared on the measurements by sex using univariate tests. Factor analysis was used to identify important components of body composition differences, and these were tested for differences between groups. The effects of age and parity on body build were removed for the analysis.

Results indicate that settled males and females have greater fat stores than nomads. No differences were found between male groups regarding fat-free mass . However, nomadic females develop more lean tissue and are larger than settled females.

Differences in body composition between groups are attributed to differences in diet, disease, and activity. The settled diet based primarily on grains

may be calorically sufficient to encourage fat tissue stores, but deficient in protein necessary for fat-free tissue development and growth. The high protein, low calorie nomadic diet may contribute to maintaining fat-free mass but not adipose tissue. Increased exposure to pathogens may contribute to differences in overall body composition by increasing the nitrogen and amino acid requirements of the settled population. Differences in physical activities may be responsible for some bodily differences by encouraging muscle hypertrophy.

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The morphometric relationship of Upper Cave 101 to modern *Homo sapiens:* an unweighted analysis. DL CORNELL and RL JANTZ, University of Tennessee, Knoxville, TN 37996.

Upper Cave 101 (UC101), or the "Old Man", is a 25,000 year old *Homo sapiens* skull from Zhoukoudian, China. The specimen's affinities are controversial because it is notably larger and more robust than modern East Asians, calling the prospect of regional continuity into question. Cornell and Jantz (1997, AJPA *Suppl. 24*:95) found, using canonical discriminant analysis, that the skull sorted with Polynesian (especially Easter Island), European, and Amerindian populations respectively. However, it was brought to our attention that a method that allows the fossil itself to help define the canonical space would also be an appropriate tool to use to assess the Old Man's ethnic affinities.

Accordingly, we compared the fossil to modern populations using an unweighted canonical discriminant function in which UC101 contributes to the axes. Our modern samples are from Howells' database of 28 populations as well as 3 Amerindian populations from the database at the University of Tennessee. The analysis shows UC101 to be distinctive on the first axis, which is predominantly size, while on the subsequent axes, especially after the fifth canonical variate, it becomes less unique. The second through fifth axes ally the skull to Australo-Melanesian, African, North Pacific, European, and Polynesian populations based on specific cranial complexes, such as UC101's relatively long, narrow skull, facial forwardness, wide frontal bone, lack of alveolar prognathism, and midfacial projection. Additionally, we performed a distance analysis of UC101 which classified the fossil as closest to Easter Island, Norse, and Berg respectively.

The unweighted canonical discriminant function performed here yields similar results to the weighted canonical discriminant function we performed last year. Once again, the Old Man's similarities to Easter Island appear to be substantial. While we see the basis for the assertion that the fossil has its closest affinities with Melanesian populations, this is overridden by its Polynesian and North Pacific Island similarities. The only significant divergent result between the two studies is that the one performed here does not associate the fossil as closely to Amerindian populations. However, we still see Polynesian and European similarities, as well as a lack of resemblance to any of the Asian populations that were represented in our sample.

Biocultural dynamics of contemporary colonizing populations: Black Caribs of Central America. M.H.CRAWFORD, Department of Anthropology, University of Kansas, Lawrence, KS 66045.

Humans originated in Africa and demically expanded their range to most of the climatic regions of the world. Over thousands of years of evolution, this human expansion was driven by fertility rates in populations outstripping the mortality. Technological developments associated with food procurement and survival further fueled this increase in fertility and concomitant decrease in mortality. At this time it is difficult to deduce the exact dynamics of the colonizing hominid populations, yet models can be developed based on contemporary populations, such as the Black Caribs of Central America. This presentation focuses on the biocultural adaptation of the Black Caribs and considers the evolutionary implications of numerically expanding groups, such as the Siberians who crossed the Bering Strait and peopled the Americas.

The Black Caribs provide a contemporary example of a successful colonizing population. Since 1800, the triracial founding population of fewer than 2000 individuals expanded numerically to over 100,000. One founding village in Honduras underwent a series of successive fissions to eventually produce 54 populations distributed over 1500 kilometers of Central American coastline. The success of these colonizing populations can be attributed to: exceptional fertility (average of 10.9 offspring per woman, > 45 years of age), reduced mortality, high genetic heterozygosity, and an adaptation to malaria. The interaction of these variables is explored using a Monte Carlo computer simulation, with probabilities based on actual demographic data.

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The backbone of history: an historian's perspective. PHILIP D CURTIN, Department of History, the Johns Hopkins University, Baltimore, MD 21218.

This paper discusses what history can derive from longitudinal studies covering considerable periods of time and based on similar evidence, like the evidence provided by human skeleton and discussed in the project on Health and Nutrition in the Western Hemisphere.

The problems of assessing the quality of life over the long term of several millennia are very different from those of shorter-run studies. While the problems are greater in the long-run studies, the potential pay-off in

increased understanding of human history is also greater. The paper considers various examples.

Steckel's proposed health index opens problems and advantages similar to other long-term studies. Valuable as it is, it should be handled with care and the full recognition of areas on evidence that cannot be taken into account. Important diseases missing from skeletal evidence would be one example.

One of the most valuable contributions of this project is to demonstrate that interdisciplinary cooperation can result in new questions and new answers that neither discipline had handled adequately in the past. This time, the solution came from history, economics, and bio-anthropology working together. One suggestion for future research is that other disciplines might well be included. Ecology and historical epidemiology are obvious possibilities. Other disciplinary combinations might well open a whole range of questions and answers that would illuminate human history in new ways.

A mandible of *Mabokopithecus clarki* sheds new light on oreopithecid evolution. B.R. BENEFIT, S.N. GITAU, M.L. McCROSSIN and A.K. PALMER. Anthropology Dept., Southern Illinois University, Carbondale, IL 62901.

Excavations at Maboko Island in 1997 resulted in the discovery of a nearly complete female mandible with I1-M3 of the 15 ma oreopithecid *Mabokopithecus clarki* Von Koenigswald, 1969. Prior to this find, *Mabokopithecus* was represented by only two isolated lower M3s from Maboko Island. Erupting M3s in the new mandible are virtually identical to KNM-MB 76 (the type of *Mabokopithecus clarki*) and differ from lower M3s of *Nyanzapithecus pickfordi* Harrison, 1986 in having a distinctive buccally recurved crown, convergence of crests from the prehypocristid and postprotocristid creating a structure homologous to a centroconid, and an entoconid-hypoconid crest forming the mesial border of the distal fovea.

The occurrence of two oreopithecids at Maboko Island is puzzling because they are virtually identical in body size and morphological adaptations to diet, and share a highly restricted spatial distribution in the deposit. The two species are more similar to one another in morphology than either is to *Nyanzapithecus vancouveringi,* and are probably congeneric. Deciding whether they are conspecific is difficult. Detailed comparisons are made between the *Mabokopithecus* mandible and two *Nyanzapithecus* mandibles found on Maboko in 1996 and 1997. Relative to *N. pickfordi, Mabokopithecus* has: 1) a strongly developed planum alveolare (virtually absent in *N. pickfordi*), 2) more robust mandibular corpus, 3) more vertical ramus, 4) less caniniform I2, 5) P3 with a taller lingual cingulum and a small metaconid (as opposed to unicuspid crown), 6) more strongly developed lower molar protoconid cingulum, 7) slightly larger M2s and M3s, and 8) an M2 hypoconulid that is more centrally positioned and shares a continuous wear facet with the entoconid rather than the posthypocristid. At present no isolated male canines are assigned with confidence to either species. The likelihood that differences between the "female" mandibles indicate a high level of dental variation within a single taxon, or male and female differences in a species that is not sexually dimorphic, is assessed.

Putting skeletal variation to work - provenancing Australian aboriginal remains. C. M. BENNETT and C. PARDOE, Department of Anthropology, South Australian Museum, Adelaide, SA 5000.

Unprovenanced remains comprise 20 percent of museum collections, or over a thousand individuals, Australia-wide. Less than one third of these have any documentation, and only some have enough information for us to determine their place of origin.

The National Skeletal Provenancing Project, based at the South Australian Museum, seeks to identify the most likely provenance for those human skeletal remains held in Australian museums that have no such information registered. Archival research has resulted in 185 individuals being provenanced from examination of archival sources. A further 16 individuals have been 'deprovenanced' where mismatches occur between registration information and the skeletal remains.

The principle work to be presented here is the biological research - the development of a 'morphological map' of Australia against which measurements of individual skeletons can be compared and their most likely place of origin identified on the basis of morphological similarity. Rather surprising results followed a critical assessment of variability, reliability and concordance of measurements taken on Aboriginal skeletal remains by different observers over the years.

Results of double blind comparisons of provenance determined independently by archival and biological means will be presented. The level of resolution possible will depend on the coverage and quality of comparative data made available to the project. Individual success in provenancing will vary according to completeness and condition of the skeleton. There is, however, valid ethical, political and scientific justification for doing as much as possible to provenance remains, and to demonstrate to indigenous people a practical application of skeletal research that addresses their concerns.

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A comparison of childhood morbidity and mortality in two Late Medieval cemeteries in Denmark. P. BENNIKE[1], M.E. LEWIS[2], H. SCHUTKOWSKI[3] and F. VALENTIN[4], Univ. of Copenhagen, Denmark[1], Univ. of Bradford, U.K.[2], Goettingen University, Germany[3], National Museum of Natural History, (I.P.H.), Paris, France[4].

Two contrasting non-adult skeleton samples from Medieval Denmark were evaluated using stress

indicators, growth, age at death and bone mineral content. The first sample consisted of 76 children interred in a cemetery utilised by the leprosarium at Næstved and, the second of 184 non-adults buried in a cemetery at Æbelholt Monastery.

The results were interpreted in the light of the 'Osteological Paradox' which questioned, among others, the hypothesis that individuals displaying pathological lesions and stress indicators in a skeletal sample represent the most disadvantaged individuals from that society.

Our results revealed that those from Næstved, as the most socio-culturally disadvantaged and biologically stressed group did, in general, display significantly more stress indicators. However, when the individual age groups of the two samples were compared, the picture becomes far more complicated.

This study has also shown that some of the methodologies used for skeletal studies may hide the true pattern of a past population. Therefore it is essential to be aware of the cultural context from which the sample is derived.

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Reproduction and ecology in Provincia Aroma, Bolivia: Fecundity of women with low levels of salivary progesterone. G.R. BENTLEY, U. of Cambridge, UK, V.J. VITZTHUM, U. of California, Riverside, USA, E. CACERES, H. SPIELVOGEL, Instituto Boliviano de Biología de Altura, La Paz, K. CRONE, L. MAY, and R.T. CHATTERTON, Northwestern U, USA.

There is significant interpopulational variation in levels of salivary progesterone (SP). How this might affect fecundity has been untested despite speculation that low levels of salivary steroids among women in less developed countries imply lower fecundity and fertility. To address this issue we report comparisons of SP levels during conception and non-conception cycles in rural Bolivian and urban Western women, aged 23-39.

Saliva samples for radioimmunoassay of steroids, and urine samples for analysis of human chorionic gonadotropin (indicating pregnancy status), were collected serially from 200 lactating and non-lactating (NL), non-contracepting Aymara women from 30 altiplano communities for 11 months throughout 1996. At the same time, saliva and urine samples were collected from a preliminary, comparative sample of 20 healthy, NL, U.S. and British women attempting to conceive.

Mean SP levels are significantly lower in Aymara than the U.S./British subjects, and both lactating and NL Aymara women conceived at markedly lower SP levels than those considered clinically "normal." Ongoing analyses will address: if SP levels are significantly higher in conception cycles versus ovulatory, non-conception cycles among the rural Aymara women; if SP profiles are qualitatively different between rural Aymara and Western women; if NL, age-matched Aymara women take longer to conceive than NL, Western women; and if early miscarriage rates are higher among the rural Aymara women.

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Study of Genetic Polymorphism of Microsattelite marker D21S11 in the Jat Sikh Population of Punjab. AJS BHANWER[1], SK MAHAJAN[2], IS SIDHU[1], KIRANDEEP KAUR[1], DS JOSHI[2], R MUKHOPADHAYA[2], R GANGABHAGIRATHI[2] and SKG SHETTIGAR[3], [1]Department of Human Genetics, Guru Nanak Dev University, Amritsar, 143 005, INDIA, [2]Molecular Biology and Agriculture Division,[3]Medical Division, BARC, Trombay, Mumbai, 400 085, INDIA.

Microsatellite markers are 2-6 bp long tandemly repeated sequences of DNA and these repeats are present throughout the human genome. They are highly variable genetic markers. The present study is the first attempt to present the preliminary data on microsatellite marker D21S11of human chromosome 21, in a distinctly endogamous group, Jat Sikhs of Punjab. The blood of 40 unrelated individuals was collected and the DNA was isolated using a modified protocol of Miller et al. (1988). The DNA samples were then analysed by Hot PCR, where one of the primers described for D21S11 marker by Sharma and Litt (1992), was labelled with P-32-γ-ATP. The PCR products were then run on a denaturing sequencing gel along with ATGC marker ladder and the alleles were analysed after autoradiography.

The total number of alleles observed in 80 chromosomes were 8 and their allele size varied from 212-240 bp with a 4 bp difference between two alleles. The average heterozygosity observed at this locus was 82.5% and the allele of 224 bp was found to be most frequent(25%). By comparing the data with other Indian and Caucasian populations it is evident that the Jat Sikh population may have evolved from a subgroup of Caucasian population, like other North-Western Indian population but the subgroups for Jat Sikh and Indian populations may be different from each other as some alleles are found only among Jat Sikhs and Caucasian population while other are present only in Jat Sikh and Indian population.